Chapter 6

Recommendations

The following discussion presents EPA's recommendations for addressing sediment contamination throughout the country and for improving the ability to conduct sediment quality assessments. These recommendations relate to five activities or information needs:

1. Further investigate conditions in the 96 targeted watersheds.
2. Coordinate efforts to address sediment quality through watershed management programs.
3. Incorporate a weight-of-evidence approach and measures of chemical bioavailability into sediment monitoring programs.
4. Evaluate the National Sediment Inventory's (NSI's) coverage and capabilities and provide better access to information in the NSI.
5. Develop better monitoring and assessment tools.

Recommendation 1: Further Investigate Conditions in the 96 Targeted Watersheds

To characterize the incidence and severity of sediment contamination in the United States, EPA has performed a screening-level analysis of the information in the NSI, the results of which are presented in Chapter 3. As mentioned previously, the results of the NSI data evaluation alone should not be used as justification for taking corrective actions at potentially contaminated sites. The initial evaluation of NSI data was performed as a means of screening and targeting. Additional, site-specific data and information should be gathered to verify the NSI evaluation results and to support a comprehensive assessment of the incidence and severity of sediment contamination problems.

The primary recommendation resulting from the NSI data analysis is to encourage further investigation and assessment of contaminated sediment. States, in cooperation with EPA and other federal agencies, should proceed with further evaluations of the 96 watersheds containing areas of probable concern for sediment contamination (APCs). In many cases, it is likely that much additional investigation and assessment has already occurred, especially in well known areas at risk for contamination, and some areas have been remediated. If active watershed management programs are in place, these evaluations should be coordinated within the context of current or planned actions. Future monitoring and assessment efforts should focus on areas such as the 57 water body segments (or river reaches) located within the 96 watersheds containing APCs that had 10 or more stations categorized as Tier 1. The purpose of these efforts should be, as appropriate, to gather additional sediment chemistry data and related biological data and conduct further assessments of the data to determine human health and ecological risk, determine temporal and spatial trends, identify potential sources of sediment contamination and determine whether potential sources are adequately controlled, and determine whether natural recovery is a feasible option for risk reduction. Additional monitoring and analysis of data from the 96 watersheds containing APCs will also be used to track and document the effectiveness of management actions taken to address sediment contamination problems over time. Trends in sediment contamination in the 96 APCs over time will be reported in future reports to Congress.

Available options for reducing health and environmental risks from contaminated sediment include physical removal and land disposal; subaqueous capping; *in situ* or *ex situ* biological, physical/chemical, or thermal treatment to destroy or remove contaminants; and natural recovery through continuing deposition of clean sediment. Assuming further investigation reveals the need for management attention to reduce risks, the preferred means depends on factors such as the degree and extent of contamination, the value of the resource, the cost of available options, likely human and ecological exposure, and the acceptable time period for recovery. If risk managers anticipate a lengthy period of time prior to recovery of the system, state and local authorities can

consider options such as placing a fish consumption advisory on water bodies or portions of water bodies where a significant human health risk exists.

Many state and federal government monitoring programs already do a good job of gathering data at locations with known contamination problems (including some of the 96 APCs), and additional monitoring at those locations will probably not be necessary. However, for other locations not previously targeted for focused monitoring, additional data might be required to adequately assess potential sediment contamination problems, especially in areas where significant human health exposures occur. In addition, in some cases it might be necessary to conduct baseline studies to determine where to focus monitoring activities.

Further investigation might reveal that risks are minimal or that natural recovery has diminished risk or will diminish risk in an acceptable time period, or it might verify that current contamination is significant and unlikely to sufficiently improve under existing conditions. Following verification of sediment contamination problems based on these additional assessments, appropriate actions (e.g., remediation, permit review, TMDL assessment, best management practices for nonpoint sources, or "no action") should be taken to address the problem. In many cases, the mechanisms for corrective actions are already in place (e.g., permit review, TMDL assessments) and responsible parties have already been identified. In other cases, the states should work with EPA to determine the best course of action.

Recommendation 2: Coordinate Efforts to Address Sediment Quality Through Watershed Management Programs

The watershed approach is a community-based water resource management framework that requires a high level of interprogram coordination to consider all factors contributing to water and sediment quality problems and to develop integrated, science-based, cost-effective solutions that involve all stakeholders. It is within the watershed framework, therefore, that EPA recommends that federal, state, and local government agencies pool their resources and coordinate their efforts to address their common sediment contamination issues. These activities should support efforts such as selection of future monitoring sites, setting of priorities for reissuance of NPDES permits, permit synchronization, total maximum daily load (TMDL) development, and pollutant trading between nonpoint and point sources.

The NSI provides an important tool for targeting efforts to further investigate the 96 watersheds containing APCs. It is also useful for screening additional potential areas of concern where there are known data gaps. In addition, the targeting technique used for identifying the APCs is directly applicable to local-level analysis because it uses site-specific information. As the NSI is expanded, it will provide further information to help environmental managers better understand which of the Nation's watersheds have sediment contamination problems that pose the greatest risk to aquatic life and human health, and track progress in addressing those problems.

There are many active watershed management efforts. EPA recommends strengthening and expanding these efforts, as appropriate, to better address sediment contamination issues. The majority of the NSI data were obtained by local watershed managers from monitoring programs targeted toward areas of known or suspected contamination. NSI data and evaluation results can assist local watershed managers by providing additional data that they may not have, enabling them to compare their sites to others throughout the region or country, demonstrating the application of a weight-of-evidence approach for identifying and screening contaminated sediment locations, and allowing researchers to draw upon a large data set of information to conduct new analyses that ultimately will be relevant for local assessments and responses.

An important component of watershed management is to educate and engage all stakeholders in government, industry, and the community. The NSI can help explain the need to establish pollution prevention initiatives for point sources and nonpoint sources that might go beyond current practices. For example, chemical use practices in industry and by landowners, homeowners, and local governments might need to be changed to prevent, reduce, or eliminate potential sources of sediment contaminants.

Recommendation 3: Incorporate a Weight-of-Evidence Approach and Measures of Chemical Bioavailability into Sediment Monitoring Programs

As stated in Chapter 2 of this volume, the ideal assessment methodology would be based on matched data sets of multiple types of sediment quality measures to take advantage of the strengths of each measurement type and to minimize their collective weaknesses. For example, sediment chemistry can indicate the amount of

contaminant present, but cannot definitively indicate an effect. On the other hand, toxicity tests or benthic community surveys can indicate an effect, but cannot definitively implicate a chemical cause. However, matched sediment chemistry data and toxicity tests, especially linked through innovative toxicity identification evaluation (TIE) approaches, can provide a preponderance of evidence implicating a chemical cause of a biological effect. This advocacy of a weight-of-evidence approach is supported by the consensus of participants in an expert workshop on sediment ecological risk assessment sponsored by the Society of Environmental Toxicology and Chemistry held in Pacific Grove, California, in April 1995. These scientists concluded that no single approach provides the best answer for risk assessment, but each endpoint has strengths and weaknesses and the best approach is to use multiple endpoints (Ingersoll et al., 1997). Toward this end, monitoring programs should be planned and executed to support weight-of-evidence assessments.

EPA recommends that future sediment monitoring programs collect tissue residue, biological effects (i.e., toxicity, histopathology), and biological community (e.g., benthic abundance and diversity) measurements. These types of data are necessary to better assess actual effects resulting from exposure to contaminated sediment. Matched sediment chemistry and tissue residue data should be collected where human exposures are a concern. In areas where aquatic life effects are a concern, monitoring programs should collect matched sediment chemistry and biological effects data and biological community measurements. There is a need to evaluate matched sediment chemistry and toxicity data to determine the predictive ability of screening values to correctly classify toxicity and minimize both Type I (false positive) and Type II (false negative) errors.

Collection of measures of chemical bioavailability is critical to the success of weight-of-evidence assessments. As noted in the previous chapter, a large number of stations had elevated concentrations of metals. However, many of these stations could not be categorized as Tier 1 because of a lack of acid volatile sulfiide (AVS) and simultaneously extracted metals (SEM) data, which were required to place stations in the Tier 1 category based on sediment contamination from cadmium, copper, nickel, lead, or zinc. AVS and SEM provide information necessary to assess the bioavailability of metals in sediment, and future sediment monitoring programs should specify collection of AVS and SEM measurements where metals are a concern.

Total organic carbon (TOC) data were also lacking for many monitoring stations with data in the NSI. TOC, like AVS and SEM, provides information related to the bioavailability of contaminants—in this case, nonionic organic chemicals. Because of the lack of site-specific TOC data, a default TOC value was used in the NSI evaluation in the comparison of measured sediment chemistry values to screening values. This approach resulted in the possible overestimation or underestimation of potential impacts. Therefore, EPA recommends that future monitoring programs also include TOC measurements where organic chemicals are a concern.

Recommendation 4: Evaluate the NSI's Coverage and Capabilities and Provide Better Access to Information in the NSI

The NSI is currently limited in terms of the number of data sets it includes and the national coverage it provides. Over 50 percent of the monitoring stations evaluated in the NSI are located in eight states (Washington, Florida, Illinois, California, Virginia, Ohio, Massachusetts, and Wisconsin). In addition, only 11 percent of all river reaches in the United States include one or more sampling stations that were assessed as part of the NSI data evaluation.

EPA should continue compiling sediment chemistry data and related biological data in the NSI to:

- Obtain a greater breadth of coverage across the United States.
- Increase the number of water bodies evaluated.
- Include additional data for more chemicals of concern.
- Provide more recent data for evaluation for future reports to Congress.

During the course of developing and compiling the NSI, commentators and reviewers identified several additional databases that should be included in the NSI for future evaluations. Those databases and others should be evaluated and added to the NSI in the future as appropriate. EPA plans to obtain the most recent data from databases currently in the NSI (e.g., STORET and ODES) and add new data from recent monitoring efforts targeted at specific water bodies, states, or other areas that are currently underrepresented in the NSI.

Although some historical trend information is available, a comprehensive assessment of temporal trends is not presented in the current report to Congress. EPA should consider whether to design future evaluations of the NSI data to determine where and why sediment quality conditions are improving or worsening. EPA plans to develop an approach for assessing temporal trends that might include, for example, a statistical analysis of recent and older data from national databases that are updated on a regular basis, such as STORET, ODES, and the National Oceanic and Atmospheric Administration's NS&T database. In addition, in the search for additional databases for use in future NSI data evaluations, EPA should focus on obtaining sediment core data, which can provide valuable information concerning historical trends in sediment contamination. An assessment of temporal trends in sediment contamination will provide valuable information concerning the effectiveness of measures taken to control the release of sediment contaminants.

The NSI can be a powerful tool for water resource managers at the national, regional, state, watershed, and water body levels. It provides in a single place a wealth of information that could be very useful, especially with improved access and availability. Multiple agencies should have access to the same data for decision makers in regional management, state-level management, and watershed-level management.

Plans are under development to make this happen. By the summer of 1997 the NSI data, organized by watershed and including maps and summary tables, should be available on EPA's mainframe computer for on-screen viewing and download. In addition, near future plans are to make this information available on EPA's World Wide Web site. EPA has also included the NSI data in its comprehensive GIS/modeling system, BASINS (Better Assessment Science Integrating Point and Nonpoint Sources). Future activities should include the addition of the NSI evaluation tools to BASINS to allow users to query the NSI evaluation results. For managers, this could be useful for identifying watersheds, water bodies, or sampling stations where various sediment chemistry and/or biological screening values have been exceeded. Identifying potential point and nonpoint sources of sediment contaminants is also critical.

Increased access to data and information in the NSI has many implications. At the national level, the data and information can:

- Demonstrate the need and provide impetus for increased pollution prevention efforts.
- Demonstrate the need for safer or biodegradable chemicals.
- Determine relative risk compared to other problems.

At the state and watershed level, better access to NSI information can help in:

- Educating and involving the public.
- Setting goals and prioritizing activities and expenditures.
- Evaluating the adequacy and effectiveness of control actions, clean-up activities, and other management actions.

Related to source identification are plans under way at the Agency for one-stop reporting of and access to integrated information about the environmental performance and emissions of major industrial facilities and other pollution sources. States and EPA will give every major industrial facility and other type of facility generating, storing, and disposing of hazardous and toxic wastes a unique identifying number. This number will be used by states and EPA to link all environmental information related to the facility. NSI development will be linked to these Agency-level efforts.

Interagency and intergovernmental cooperation is essential for enhancing NSI information, coverage, and comprehensiveness. Reporting of water quality information and environmental indicator development at the Office of Water are important ongoing efforts related to the collection of information from state agencies (through 305(b) reporting), other federal agencies, and the private sector. Efforts for future data collection for the NSI should be integrated into these related initiatives.

Recommendation 5: Develop Better Monitoring and Assessment Tools

The National Sediment Quality Survey is the first attempt to analyze sediment chemistry and biological data from numerous databases from across the country in an effort to identify the national incidence and severity of sediment contamination. Because the data were not generated by a single monitoring program designed at the outset to provide this national picture, numerous hurdles had to be overcome to analyze the data with as little bias and as much scientific validity as possible. This exercise itself provided an opportunity to assess the needs to develop better basic and applied science with respect to sediment chemistry data and related biological data.

To ensure effective quality control and quality assurance management, monitoring programs should adopt standard sample collection, storage, analyses, and documentation procedures. Lack of available quality control information and the recognized limitations of some past sampling and analyses methods necessarily restricts the interpretation of much of the historical data base. However, these limitations should be eliminated in the future through current practices such as "clean" laboratory techniques, lowered analytical detection limits, and better record keeping. Modernization of federal and other data repositories to accommodate the storage of much additional valuable and relevant information should help facilitate the process.

During the evaluation of information in the NSI, analysts continually came up against the limitations of available tools and techniques to assess the sediment contaminant information. Although screening values were adopted or developed for the NSI data evaluation wherever feasible, many data for some potentially sharmful contaminants were not evaluated. For example, many contaminants included in the NSI, such as kepone and tributyl tin, could not be evaluated due to a lack of appropriate screening values for comparison with measured values.

The sediment quality evaluation tools used for the current NSI data evaluation should be used as the basis for further methods development. As sediment quality data become more available and the state of the science for sediment assessment evolves, assessment methods will also evolve. For example, new and better screening values and laboratory tests for biological effects will be developed. EPA should incorporate new sediment assessment techniques into future NSI data evaluations as they are developed, tested, and proven reliable. For example, although biological community data were included in the NSI, the data were not evaluated for this report to Congress because there is little agreement among sediment assessment experts concerning biological community conditions that can be directly related to sediment quality problems. EPA should work to develop these and other sediment assessment tools for future assessments. EPA needs to evaluate the ecological relevance of the assessment tools used to evaluate contaminated sediment.

Other relevant issues and science needs that should be addressed to better characterize the sources, fate, and effects of sediment contaminants include:

- Methods to better predict the fate and transport of sediment contaminants.
- Methods to predict or track atmospheric sources and cross-media transfers of sediment contaminants such as mercury, pesticides, PCBs, and PAHs.
- Bioavailability of compounds other than nonionic organics.
- Estimates of land use impacts on sediment conditions (predictive capabilities).
- Methods for fingerprinting chemicals for source identification.

In the context of the budget process, EPA and other federal agencies should evaluate whether to request funding to support the development of tools to better characterize the sources, fate, and effects of sediment contaminants.